CLAIMS

What is claimed is:

1. A fiber optic module for coupling photons between optoelectronic devices and optical fibers, the fiber optic module comprising:

a base having a first, a second, a third and a fourth opening;

a first vertical printed circuit board (PCB) arranged parallel to a first optical axis of a first optoelectronic device, the first optoelectronic device having terminals coupled to the first vertical printed circuit board, the first vertical printed circuit board arranged perpendicular to the base, the first vertical printed circuit board having a plurality of pins extending through the first opening in the base to couple to a system;

a second vertical printed circuit board (PCB) arranged parallel to a second optical axis of a second optoelectronic device, the second optoelectronic device having terminals coupled to the second veritcal printed circuit board, the second vertical printed circuit board arranged perpendicular to the base, the second vertical printed circuit board having a plurality of pins extending through the second opening in the base to couple to the system;

a third vertical printed circuit board (PCB) arranged parallel to a third optical axis of a third optoelectronic device, the third optoelectronic device having terminals coupled to the third vertical printed circuit board, the third vertical printed circuit board arranged perpendicular to the base, the third vertical printed circuit board having a plurality of pins extending through the third opening in the

base to couple to the system;

a fourth vertical printed circuit board (PCB) arranged parallel to a fourth optical axis of a fourth optoelectronic device, the fourth optoelectronic device having terminals coupled to the fourth vertical printed circuit board, the fourth vertical printed circuit board arranged perpendicular to the base, the fourth vertical printed circuit board having a plurality of pins extending through the fourth opening in the base to couple to the system; and

a shielded housing coupled to the base to encase the first vertical, second vertical, third vertical, and fourth vertical printed circuit boards to reduce electromagnetic interference (EMI).

2. The fiber optic module of claim 1 further comprising:

an optical block coupled to the first, second, third and fourth optoelectronic devices, the optical block having

a first, second, third and fourth openings to receive the first, second, third and fourth optoelectronic devices respectively, and

a first, second, third, and fourth lens to couple photons between the first, second, third and fourth optoelectronic devices and first, second, third and fourth optical fibers respectively.

3. The fiber optic module of claim 2 further comprising:

a nose coupled to the base, the nose to receive an optical fiber connector and to hold the first, second, third and fourth optical fibers substantially fixed and aligned with the first, second, third, and fourth optical openings of the optical block.

4. The fiber optic module of claim 3 further comprising:

a nose shield surrounding the nose to reduce electromagnetic interference.

5. The fiber optic module of claim 1 wherein,

the third vertical printed circuit board and the third optoelectronic device and the fourth vertical printed circuit board and the fourth optoelectronic device to provide redundancy for the fiber optic module.

6. The fiber optic module of claim 1 wherein,

the first vertical printed circuit board and the first optoelectronic device; the second vertical printed circuit board and the second optoelectronic device; the third vertical printed circuit board and the third optoelectronic device; and the fourth vertical printed circuit board and the fourth optoelectronic device to provide a four channel fiber optic module.

7. A fiber optic module for coupling photons between optoelectronic devices and optical fibers, the fiber optic module comprising:

a base;

at least a pair of vertical printed circuit boards arranged parallel to a first optical axis of a first optoelectronic device and parallel to a second optical axis of a second optoelectronic device respectively, the first optoelectronic device having terminals coupled to one of the vertical printed circuit boards and the second optoelectronic device having terminals coupled to another one of the vertical printed circuit boards, the at least pair of vertical printed circuit boards being arranged perpendicular to the base;

at least a third printed circuit board (PCB) arranged parallel to a third optical axis of a third optoelectronic

device, the third optoelectronic device having terminals coupled to the third printed circuit board; and

at least a fourth printed circuit board (PCB) arranged parallel to a fourth optical axis of a fourth optoelectronic device, the fourth optoelectronic device having terminals coupled to the fourth printed circuit board.

8. The fiber optic module of claim 7 further comprising:

a housing coupled to the base.

9. The fiber optic module of claim 8 wherein,

the housing is a shielded housing to encase the at least pair of vertical printed circuit boards and the at least third and the at least fourth printed circuit boards to reduce electromagnetic interference (EMI).

10 The fiber optic module of claim 7 further comprising:

an optical block coupled to the first, second, third and fourth optoelectronic devices, the optical block having

a first, second, third and fourth openings to receive the first, second, third and fourth optoelectronic devices respectively, and

a first, second, third, and fourth lens to couple photons between the first, second, third and fourth optoelectronic devices and first, second, third and fourth optical fibers respectively.

11. A fiber optic module for coupling photons between optoelectronic devices and optical fibers, the fiber optic module comprising:

a base having a first, a second, a third and a fourth opening;

a first horizontal printed circuit board (PCB) arranged parallel to a first optical axis of a first optoelectronic device, the first optoelectronic device having terminals coupled to the first horizontal printed circuit board, the first horizontal printed circuit board arranged parallel to the base, the first horizontal printed circuit board having a plurality of pins extending through the first opening in the base to couple to a system;

a second horizontal printed circuit board (PCB) arranged parallel to a second optical axis of a second optoelectronic device, the second optoelectronic device having terminals coupled to the second horizontal printed circuit board, the second horizontal printed circuit board arranged parallel to the base, the second horizontal printed circuit board having a plurality of pins extending through the second opening in the base to couple to the system;

a third horizontal printed circuit board (PCB) arranged parallel to a third optical axis of a third optoelectronic device, the third optoelectronic device having terminals coupled to the third horizontal printed circuit board, the third horizontal printed circuit board arranged parallel to the base, the third horizontal printed circuit board having a plurality of pins extending through the third opening in the base to couple to the system;

a fourth horizontal printed circuit board (PCB) arranged parallel to a fourth optical axis of a fourth optoelectronic device, the fourth optoelectronic device having terminals coupled to the fourth horizontal printed circuit board, the fourth horizontal printed circuit board arranged parallel to the base, the fourth horizontal printed circuit board having a plurality of pins extending through the fourth opening in the base to couple to the system; and

a shielded housing coupled to the base to encase the

first horizontal, second horizontal, third horizontal, and fourth horizontal printed circuit boards to reduce electromagnetic interference (EMI).

12 The fiber optic module of claim 11 further comprising:

an optical block coupled to the first, second, third and fourth optoelectronic devices, the optical block having

a first, second, third and fourth openings to receive the first, second, third and fourth optoelectronic devices respectively, and

a first, second, third, and fourth lens to couple photons between the first, second, third and fourth optoelectronic devices and first, second, third and fourth optical fibers respectively.

13. The fiber optic module of claim 12 further comprising:

a nose coupled to the base, the nose to receive an optical fiber connector and to hold the first, second, third and fourth optical fibers substantially fixed and aligned with the first, second, third, and fourth optical openings of the optical block.

14. The fiber optic module of claim 13 further comprising:

a nose shield surrounding the nose to reduce electromagnetic interference.

15. The fiber optic module of claim 11 wherein,

the third horizontal printed circuit board and the third optoelectronic device and the fourth horizontal printed

circuit board and the fourth optoelectronic device to provide redundancy for the fiber optic module.

16. The fiber optic module of claim 11 wherein,

the first horizontal printed circuit board and the first optoelectronic device; the second horizontal printed circuit board and the second optoelectronic device; the third horizontal printed circuit board and the third optoelectronic device; and the fourth horizontal printed circuit board and the fourth optoelectronic device to provide a four channel fiber optic module.

17. A fiber optic module for coupling photons between optoelectronic devices and optical fibers, the fiber optic module comprising:

a base having a first, a second, a third and a fourth opening;

a first vertical printed circuit board (PCB) arranged parallel to a first optical axis of a first optoelectronic device, the first optoelectronic device having terminals coupled to the first vertical printed circuit board, the first vertical printed circuit board arranged perpendicular to the base, the first vertical printed circuit board having a plurality of pins extending through the first opening in the base to couple to a system;

a second vertical printed circuit board (PCB) arranged parallel to a second optical axis of a second optoelectronic device, the second optoelectronic device having terminals coupled to the second vertical printed circuit board, the second vertical printed circuit board arranged perpendicular to the base, the second vertical printed circuit board having a plurality of pins extending through the second opening in the base to couple to the system;

a third horizontal printed circuit board (PCB) arranged parallel to a third optical axis of a third optoelectronic device, the third optoelectronic device having terminals coupled to the third horizontal printed circuit board, the third horizontal printed circuit board arranged parallel to the base, the third horizontal printed circuit board having a plurality of pins extending through the third opening in the base to couple to the system;

a fourth horizontal printed circuit board (PCB) arranged parallel to a fourth optical axis of a fourth optoelectronic device, the fourth optoelectronic device having terminals coupled to the fourth horizontal printed circuit board, the fourth horizontal printed circuit board arranged parallel to the base, the fourth horizontal printed circuit board having a plurality of pins extending through the fourth opening in the base to couple to the system; and

a shielded housing coupled to the base to encase the first vertical, second vertical, third horizontal, and fourth horizontal printed circuit boards to reduce electromagnetic interference (EMI).

18 The fiber optic module of claim 17 further comprising:

an optical block coupled to the first, second, third and fourth optoelectronic devices, the optical block having

a first, second, third and fourth openings to receive the first, second, third and fourth optoelectronic devices respectively, and

a first, second, third, and fourth lens to couple photons between the first, second, third and fourth optoelectronic devices and first, second, third and fourth optical fibers respectively.

19. The fiber optic module of claim 18 further comprising:

a nose coupled to the base, the nose to receive an optical fiber connector and to hold the first, second, third and fourth optical fibers substantially fixed and aligned with the first, second, third, and fourth optical openings of the optical block.

20. The fiber optic module of claim 19 further comprising:

a nose shield surrounding the nose to reduce electromagnetic interference.

21. The fiber optic module of claim 17 wherein,

the second vertical printed circuit board and the second optoelectronic device and the fourth horizontal printed circuit board and the fourth optoelectronic device to provide redundancy for the fiber optic module.

22. The fiber optic module of claim 17 wherein,

the first vertical printed circuit board and the first optoelectronic device; the second vertical printed circuit board and the second optoelectronic device; the third horizontal printed circuit board and the third optoelectronic device; and the fourth horizontal printed circuit board and the fourth optoelectronic device to provide a four channel fiber optic module.

23. A fiber optic module for coupling photons between optoelectronic devices and optical fibers, the fiber optic module comprising:

a base having a first, a second, and a third opening;

a first vertical printed circuit board (PCB) arranged parallel to a first optical axis of a first optoelectronic device, the first optoelectronic device having terminals coupled to the first vertical printed circuit board, the first vertical printed circuit board arranged perpendicular to the base, the first vertical printed circuit board having a plurality of pins extending through the first opening in the base to couple to a system;

a second vertical printed circuit board (PCB) arranged parallel to a second optical axis of a second optoelectronic device, the second optoelectronic device having terminals coupled to the second vertical printed circuit board, the second vertical printed circuit board arranged perpendicular to the base, the second vertical printed circuit board having a plurality of pins extending through the second opening in the base to couple to the system;

a third horizontal printed circuit board (PCB) arranged parallel to a third optical axis of a third optoelectronic device and a fourth optical axis of a fourth optoelectronic device, the third and fourth optoelectronic devices each having terminals coupled to the third horizontal printed circuit board, the third horizontal printed circuit board arranged parallel to the base, the third horizontal printed circuit board having a plurality of pins extending through the third opening in the base to couple to the system; and

a shielded housing coupled to the base to encase the first vertical, second vertical, and third horizontal printed circuit boards to reduce electromagnetic interference (EMI).

24. The fiber optic module of claim 23 further comprising:

an optical block coupled to the first, second, third and

fourth optoelectronic devices, the optical block having

a first, second, third and fourth openings to receive the first, second, third and fourth optoelectronic devices respectively, and

a first, second, third, and fourth lens to couple photons between the first, second, third and fourth optoelectronic devices and first, second, third and fourth optical fibers respectively.

25. The fiber optic module of claim 24 further comprising:

a nose coupled to the base, the nose to receive an optical fiber connector and to hold the first, second, third and fourth optical fibers substantially fixed and aligned with the first, second, third, and fourth optical openings of the optical block.

26. The fiber optic module of claim 25 further comprising:

a nose shield surrounding the nose to reduce electromagnetic interference.

27. The fiber optic module of claim 24 wherein,

the second vertical printed circuit board and the second optoelectronic device and the fourth optoelectronic device to provide redundancy for the fiber optic module.

28. The fiber optic module of claim 24 wherein,

the first vertical printed circuit board and the first optoelectronic device; the second vertical printed circuit board and the second optoelectronic device; and the third horizontal printed circuit board and the third optoelectronic

device and the fourth optoelectronic device to provide a four channel fiber optic module.

29. A fiber optic module for coupling photons between optoelectronic devices and optical fibers, the fiber optic module comprising:

a base having a first, a second, a third and a fourth opening;

a first vertical printed circuit board (PCB) arranged parallel to a first optical axis of a first optoelectronic device, the first optoelectronic device having terminals coupled to the first vertical printed circuit board, the first vertical printed circuit board arranged perpendicular to the base, the first vertical printed circuit board having a plurality of pins extending through the first opening in the base to couple to a system;

a second vertical printed circuit board (PCB) arranged parallel to a second optical axis of a second optoelectronic device, the second optoelectronic device having terminals coupled to the second vertical printed circuit board, the second vertical printed circuit board arranged perpendicular to the base, the second vertical printed circuit board having a plurality of pins extending through the second opening in the base to couple to the system;

a third vertical printed circuit board (PCB) arranged parallel to a third optical axis of a third optoelectronic device, the third optoelectronic device having terminals coupled to the third vertical printed circuit board, the third vertical printed circuit board arranged perpendicular to the base, the third vertical printed circuit board having a plurality of pins extending through the third opening in the base to couple to the system;

a fourth horizontal printed circuit board (PCB) arranged

parallel to a fourth optical axis of a fourth optoelectronic device, the fourth optoelectronic device having terminals coupled to the fourth horizontal printed circuit board, the fourth horizontal printed circuit board arranged parallel to the base, the fourth horizontal printed circuit board having a plurality of pins extending through the fourth opening in the base to couple to the system; and

a shielded housing coupled to the base to encase the first vertical, second vertical, third vertical, and fourth horizontal printed circuit boards to reduce electromagnetic interference (EMI).

30. The fiber optic module of claim 29 further comprising:

an optical block coupled to the first, second, third and fourth optoelectronic devices, the optical block having

a first, second, third and fourth openings to receive the first, second, third and fourth optoelectronic devices respectively, and

a first, second, third, and fourth lens to couple photons between the first, second, third and fourth optoelectronic devices and first, second, third and fourth optical fibers respectively.

31. The fiber optic module of claim 30 further comprising:

a nose coupled to the base, the nose to receive an optical fiber connector and to hold the first, second, third and fourth optical fibers substantially fixed and aligned with the first, second, third, and fourth optical openings of the optical block.

32. The fiber optic module of claim 31 further

comprising:

a nose shield surrounding the nose to reduce electromagnetic interference.

33. The fiber optic module of claim 29 wherein,

the second vertical printed circuit board and the second optoelectronic device and the fourth horizontal printed circuit board and the fourth optoelectronic device to provide redundancy for the fiber optic module.

34. The fiber optic module of claim 29 wherein,

the first vertical printed circuit board and the first optoelectronic device; the second vertical printed circuit board and the second optoelectronic device; the third vertical printed circuit board and the third optoelectronic device; and the fourth horizontal printed circuit board and the fourth optoelectronic device to provide a four channel fiber optic module.

35. A fiber optic module for coupling photons between optoelectronic devices and optical fibers, the fiber optic module comprising:

a base;

at least a pair of vertical printed circuit boards arranged parallel to a first optical axis of a first optoelectronic device and parallel to a second optical axis of a second optoelectronic device respectively, the first optoelectronic device having terminals coupled to one of the vertical printed circuit boards and the second optoelectronic device having terminals coupled to another one of the vertical printed circuit boards, the at least pair of vertical printed circuit boards being arranged perpendicular to the base and having a first and second electrical connectors to plug into

and out of an electrical connector of a host printed circuit board;

at least a third printed circuit board (PCB) arranged parallel to a third optical axis of a third optoelectronic device, the third optoelectronic device having terminals coupled to the at least third printed circuit board, the at least third printed circuit board having a third electrical connector to plug into and out of an electrical connector of the host printed circuit board; and

at least a fourth printed circuit board (PCB) arranged parallel to a fourth optical axis of a fourth optoelectronic device, the fourth optoelectronic device having terminals coupled to the fourth printed circuit board, the at least fourth printed circuit board having a fourth electrical connector to plug into and out of an electrical connector of the host printed circuit board.

36. The fiber optic module of claim 35 further comprising:

a housing coupled to the base.

37. The fiber optic module of claim 36 wherein,

the housing is a shielded housing to encase the at least pair of vertical printed circuit boards and the at least third and the at least fourth printed circuit boards to reduce electromagnetic interference (EMI).

38 The fiber optic module of claim 35 further comprising:

an optical block coupled to the first, second, third and fourth optoelectronic devices, the optical block having

a first, second, third and fourth openings to receive the first, second, third and fourth optoelectronic devices

respectively, and

a first, second, third, and fourth lens to couple photons between the first, second, third and fourth optoelectronic devices and first, second, third and fourth optical fibers respectively.

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